Breastfeeding or formula-feeding? What does Science state?

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INTRODUCTION AND OBJECTIVES

INTRODUCTION

Breastfeeding has been defined by OMS and UNICEF such as "the ideal way to provide infants with the needed nutrients for a healthy growth and development." Moreover, OMS recommends to exclusively breastfeed during the first six months of the newborns and keep it, if possible, until the first two years.

Nowadays, because of different causes, there are some mothers who can not breastfeed their children and they need to use infant formula. Therefore, it is such an importance the innovation and development of infant formula.

OBJECTIVES

- To scientifically demonstrate if infant formula provides the same benefits as breastfeeding.
- To verify if there are any differences between breastfeeding and infant formula related to intolerances, allergies and other diseases.
- To analyse if it is possible to improve nowadays infant formula quality and if it is possible to create a functional infant formula in the future.

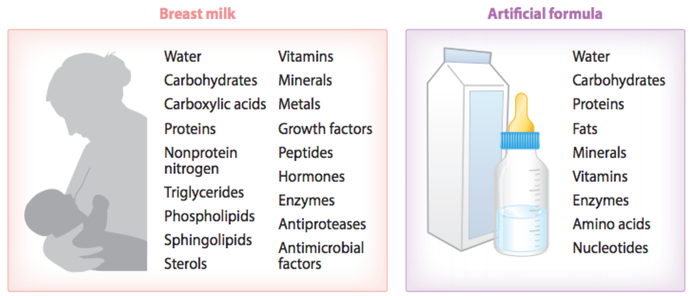

Figure 1.

The fundamental macronutrients and micronutrients presents in breast milk and infant formula (Ahern et al. 2019)

DIFFERENT TYPES OF ARTIFICIAL MILK

Table 1. **Composition of infant formulas**

Components	Start formula	Continuation formula	Growth milk
Energy (% kcal)	64-72	60-85	60-70
Protein (g)	1,2-1,6	1,8-3	1,8-3,0
Carbohydrate (g)	5,4-8,2	7-8,6	6
Lactose (g)	7	6,8	2,2
Fats (g)	2,7-4,1	2,5-4,0	4,0-6,0
Linoleic acid (mg)	400	350	240
Alfa-linolenic acid (mg)	55	47	10
Docosahexaenoic acid (mg)	13	10	26
Vitamin A (µg)	66,03	67,5	97
Vitamin D (µg)	1,2	1,1	1,5
Vitamin E (µg)	1000	1400	1300
Vitamin K (µg)	5,1	4,7	9
Thiamine (µg)	59	71	30
Riboflavin (µg)	105	108	140
Vitamin B6 (µg)	46,80	61	30
Vitamin B12 (µg)	0,16	0,2	0,3
Niacin (µg)	70	70	90
Folate (µg)	9,4	15	15
Biotin (µg)	1,5-7,5	3	1,5
Vitamin C (mg)	9	13,5	8
Calcium (mg)	60	32,5-91	110
Phosphorous (mg)	30	47	80
Iron (mg)	0,7	0,7-1,4	1,03
Zinc (mg)	0,5-1,5	0,5-1,5	0,75
Sodium (mg)	27	27	45
Potassium (mg)	72	81	150

The values are expressed in units / 100ml of product reconstituted to liquid. The nutritional information has been copied from the article *"Nutritional composition of infant milk formulas"* the review *"Leches de crecimiento en la alimentación infantil"* the article *"Estudio comparativo de la leche de mujer con las leches artificiales " and* information given by the manufacturer of the products"

Start formula I 0-6 months
Greater proteins, micronutrients and vitamins than breast milk. Is very important to adapt milk to digestive and renal immaturity conditions of newborns, improve their digestibility and tolerance.

Continuation formula I 6-12 month
50% of the daily energy
Greater energy and protein than start formula.
Lactose is partially replaced by maltodextrin and glucose polymers.
+ iron

Growth milk I +12 month
Higher contribution of energy, proteins and micronutrients than the continuation formula.
+ micronutrients such as iron, vitamins, niacin and folates

ADAPTIONS TO "HUMANIZE" THE INFANT FORMULA

First, to reduce the **protein** of the bovine milk because breast milk has less quantity. Secondly, to change the ratio casein:whey of the bovine milk from 80:20 to such is breast milk, 30:70. As the infants grow and the their digestive system starts to mature, the ratio will be eventually more similar to bovine milk.

The **dairy fats** are totally or partially substituted for vegetal polyunsaturated fatty acids in order to improve its absorption. Also, it is very important the incorporation of essential fatty acids such as DHA and AA.

Supplements of: **lactose** because bovine milk does not contain the same portion of lactose such as the breast milk, **iron**, usually iron sulphate with ascorbic acid and **vitamin D.**

Reference:
Ahern GJ, Hennessy AA, Ryan CA, Ross RP, Stanton C. 2019. Advances in Infant Formula Science. Annu Rev Food Sci Technol. 10(1):75–102.
Jardí Piñana C, Aranda Pons N, Bedmar Carretero C, Arija Val V. 2015. Composición nutricional de las leches infantiles. Nivel de cumplimiento en su fabricación y adecuación a las necesidades nutricionales. An Pediatría. 83(6):417–429.
Dalmau Serra J, Moreno Villares JM. 2011. Unweaned milk formula in a childhood diet | Leches de crecimiento en la alimentación infantil. Acta Pediatr Esp. 69(9):373–378.
Martín Martinez B. 2005. Estudio comparativo de la leche de mujer con las leches artificiales. An Pediatr, Monogr. 3(1):43–53.

DIFFERENCES IN THE DEVELOPMENT ASSOCIATED WITH FEEDING METHOD AND FUNCTIONAL COMPONENTS

DIFFERENCES IN THE DEVELOPMENT

Exclusively breastfed infants will have an intestinal microbiota characterized mainly by *bifidobacterium* and those fed by infant formula will have a more heterogeneous composition. High levels of bifidobacteria are associated with the protection against the development of allergy.

The exclusive feeding of breast milk reduces the risk of suffering certain diseases, such as respiratory (asthma) and gastrointestinal ones.

Continued breastfeeding at the time of the introduction of gluten into the diet, it has a protective effect against celiac disease.

In terms of nutritionally, scientific studies have found a relationship between breast milk and a protective effect against the overweight and obesity of infants.

FUNCTIONAL COMPONENTS IN INFANT FORMULA

Alfa-lactalbumin — Prebiotic — Probiotic
Polyunsaturated fatty acids — Nucleotide
Oligosaccharides — Lactoferrin — Osteopontin
Ingredient rich in Milk Fat Globule Membrane
Choline — L-carnitine — Inositol

These functional components improves the cerebral, renal and digestive development of the newbrons.

It participate in the maturation of the infant's immune system and improve his intestinal flora.

CONCLUSIONS

- With the different articles reviewed it has been verified that infant formula have managed to imitate breast milk nutritionally in terms of energy, macronutrients, iron and calcium. It is still needed to improve functional components related to the microbiota and the immune system. Thanks to the different bases for the formulation, all those born with allergies, intolerances or digestive problems can be fed.
- After reviewing different studies, it has been state that there is a difference in the development of the baby associated with feeding method. Infant formula presents a worse gastrointestinal adaptation, more likely to suffer from infections, develop inflammatory intestinal diseases, autoimmune, respiratory diseases such as asthma, allergies and others such as celiac disease.
- Probably, it will never be able to get a milk that perfectly imitates breast milk, as it is a living fluid that contains many biologically active factors and a microbiota that is very difficult to copy. However, thanks to the research and studies for the improvements and addition of new components, it will be possible to obtain functional infant formula.